REMARKS

Claims 1-42 are currently pending in the subject application. By the instant amendment, claims 19 and 30 are canceled, and the subject matter thereof is incorporated into claims 18 and 29, respectively. Also by the instant amendment, claims 20 and 31 are amended to correct the dependency thereof. Accordingly, no new matter is added by the instant amendment.

Claims 1-18, 20-29 and 31-42 are presented to the Examiner for further prosecution on the merits.

A Declaration under 37 C.F.R. §1.132 is being filed concurrently with the instant amendment, and a copy of the declaration is included herein in accordance with 37 CFR § 1.4(d)(2).

The Examiner is respectfully requested to give weight to the enclosed Declaration, and to reconsider the rejections in the present application in view of the statements included therein.

The enclosed Declaration is by Keum Joo Lee, a named inventor in the subject application, and an employee of Samsung Electronics Co., Ltd. (See the Declaration at paragraphs 2 and 3). Mr. Keum Joo Lee has 8 years of experience in the art of semiconductor device fabrication. (See the Declaration at paragraph 6). It is his/her opinion that one of ordinary skill in the art of semiconductor device fabrication would have a scientific degree and at least two years of experience in the design and/or fabrication of semiconductor devices. (See the Declaration at paragraph 7). Accordingly, it is respectfully submitted that Mr. Keum Joo Lee is at least one of ordinary skill in the art of semiconductor device fabrication.

Claim Rejections:

Claims 1-17 are rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 5,868,855 to Fukazawa et al. ("the Fukazawa et al. reference").

These rejections are respectfully traversed, as the Fukazawa et al. reference fails to teach each and every limitation of the present invention as claimed in independent claims 1 and 8. More particularly, claims 1 and 8 claim a method using a solution of HF and ozone water wherein the solution comprises about 0.034 to about 0.077 wt% HF. It is respectfully submitted that the claimed solution including an HF concentration range of about 0.034 to about 0.077 wt% produces surprising and unexpected results over the solution including HF taught by the Fukazawa et al. reference. (See the Declaration at paragraphs 9, 10 and 14).

The important and unexpected results obtained by the presently claimed method using a solution including about 0.034 to 0.077 wt% HF are described in the subject application at paragraphs [0028]-[0030], and are illustrated in FIG. 2 of the same. Specifically, the subject application teaches that resistance of a contact region of a semiconductor device can be reduced without causing a reduction in breakdown voltage between the contact region and a conductive layer adjacent to the contact region by cleaning the semiconductor device using a solution including about 0.034 to about 0.077 wt% HF. (See the Declaration at paragraph 10).

The Fukazawa et al. reference, however, teaches a solution including a broad HF concentration range of from 0.01 to 1 wt% of the solution, which is 23 times larger than the specific HF concentration range taught and claimed in the subject application. Furthermore, the Fukazawa et al. reference includes no disclosure or suggestion pertaining to a problem of resistance of a contact region or breakdown voltage between the contact region and a conductive layer adjacent to the contact region in a semiconductor device, and does not address effects thereto when cleaning the semiconductor device.

Accordingly, the Fukazawa et al. reference fails to disclose providing the cleaning solution set forth therein with an HF concentration range that allows a resistance of a contact region of a semiconductor device to be decreased without causing a decrease in a breakdown

voltage between the contact region and an adjacent conductive layer. Rather, the field of the Fukazawa et al. reference is interested in cleaning a wafer or substrate using hydrofluoric acid per se. Thus, there is no motivation provided in the Fukazawa et al. reference for using the solution having the very specific HF concentration range as now taught by the present invention. (See the Declaration at paragraph 13).

Therefore, it is respectfully submitted that the cleaning solution taught by the Fukazawa et al. reference having the very broad HF concentration range, would not under ordinary circumstances, i.e., without undue experimentation and manipulation thereof, provide results such as those obtained by application of the present invention as claimed. (See the Declaration at paragraph 14).

It is not obvious to select from a relatively broad range, as disclosed in the Fukazawa et al. reference, a very specific range of HF concentration in a solution that provides the benefits taught by the subject application, due to difficulties in the selection process. (See the Declaration at paragraph 11).

Therefore, it is respectfully submitted that the present invention as claimed provides surprising and unexpected results over those which one of ordinary skill in the art would have expected from the disclosure of the Fukazawa et al. reference.

Therefore, claims 1 and 8, as well as claims 2-7 and 9-17, which depend either directly or indirectly therefrom, are believed to be patentably distinguished over the Fukazawa et al. reference and in condition for allowance.

Accordingly, reconsideration and withdrawal of the rejections of claims 1-17 are respectfully requested.

Claims 18-42 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over the Fukawaza et al. reference in view of Japanese Patent No. 07-037851 to Kobayashi ("the Kobayashi reference").

However, these rejections are respectfully traversed, as independent claims 18 and 29 have been amended to include the subject matter of claims 19 and 30, respectively, which have been canceled. More particularly, independent claims 18 and 29 have been amended to include a limitation that a solution of HF and ozone water includes about 0.034 to about 0.077 wt% HF.

As described above, the Fukazawa et al. reference teaches a broad range of HF concentration in an HF and ozone water solution of 0.01% to 1%, and includes no disclosure regarding contact resistance of a contact region or breakdown voltage between the contact region and an adjacent conductive layer. The Kobayashi reference fails to disclose any particular HF concentration and includes no disclosure regarding resistance of a contact region or a breakdown voltage between the contact region and an adjacent conductive layer.

Accordingly, both the Fukazawa et al. reference and the Kobayashi reference fail to disclose providing the cleaning solutions set forth therein with an HF concentration range that allows a resistance of a contact region of a semiconductor device to be decreased without causing a decrease in a breakdown voltage between the contact region and an adjacent conductive layer. Rather, the fields of the Fukazawa et al. and Kobayashi references are interested in cleaning a wafer or substrate using hydrofluoric acid per se. Thus, there is no motivation provided in the Fukazawa et al. reference, the Kobayashi reference, or a combination thereof for using the solution having the very specific HF concentration range as now taught by the present invention. (See the Declaration at paragraph 13).

The solutions taught by the Fukazawa et al. reference and the Kobayashi reference would not, under ordinary circumstances, i.e., without undue experimentation and manipulation thereof, provide results such as those obtained by application of the present invention as claimed. (See the Declaration at paragraph 14).

Therefore, it is respectfully submitted that the present invention as claimed provides surprising and unexpected results over those which one of ordinary skill in the art would have expected from the disclosures of the Fukazawa et al. reference and the Kobayashi reference.

Accordingly claims 18, 29, and claims 20-28 and 31-42, which respectively depend either directly or indirectly therefrom, are believed to be patentably distinguished over the combination of cited prior art references and in condition for allowance.

Accordingly, reconsideration and withdrawal of the rejections of claims 18, 20-29 and 31-42 are respectfully requested.

Conclusion

In view of the remarks and amendments submitted herewith and the statements contained in the Declaration under 37 C.F.R. § 1.132 being filed concurrently herewith, applicants respectfully submit that claims 1-18, 20-29 and 31-42 are now in condition for allowance.

If the Examiner believes that additional discussions or information might advance the prosecution of the instant application, the Examiner is invited to contact the undersigned at the telephone number listed below to expedite resolution of any outstanding issues.

In view of the foregoing amendments and remarks, reconsideration of this application is earnestly solicited, and an early and favorable further action upon all pending claims is hereby requested.

Respectfully submitted,

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